BUILD A SATELLITE TO ORBIT THE MOON

OBJECTIVE

To demonstrate an understanding of Engineering Design Process while utilizing each stage to successfully complete a team challenge.

CHALLENGE

The challenge is to build a satellite that falls within certain size and weight constraints. This satellite will be designed to orbit the Moon. It will have to carry some combination of cameras, gravity probes, and heat sensors to look at or probe the Moon's surface.

PROCESS SKILLS

Measuring, calculating, designing, evaluating

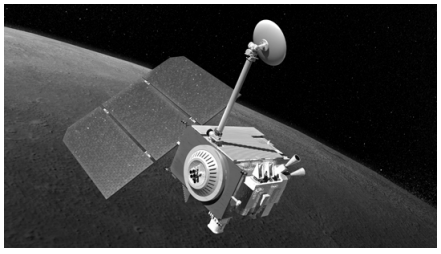
MATERIALS

General building supplies

Bag of buttons of a variety of sizes

STUDENT WORKSHEETS

Imagine and Plan (2 pages)



MOTIVATE

- Spend a few minutes asking students if they know what engineers do.
- Display the *Engineering Design Process* diagram and discuss:
  - **Ask** a question first.
  - **Imagine** a possible solution.
  - **Plan out** a design and draw your ideas.
  - **Create** and construct a working model.
  - **Experiment** and test that model.
  - **Improve** and try to revise that model.

SET THE STAGE: ASK, IMAGINE, PLAN

- Share the *Design Challenge* orally with the students (see next page).
- Have students brainstorm ideas and then create a drawing of their satellite (Imagine and Plan worksheet).

CREATE AND EXPERIMENT

- Distribute materials for students to build their satellites based on their designs and specifications.
- The Experiment phase will occur during the next activity, *Launch Your Satellite*.

IMPROVE

- If there is time, have students inspect their satellite and rework their design if needed.

CHALLENGE CLOSURE

- Ask all groups to come back to their seats to have a discussion about today's activity:
  - *Name two things you learned about what engineers do through building your satellite today.*
  - *What was the hardest thing for your team to complete while building your satellite?*
  - *How did your team solve this problem?*

PREVIEWING NEXT SESSION

Ask teams to bring back their satellite model for use at the next session. You may want to store them in the classroom or have one of the facilitators be responsible for their safe return next session.

DESIGN CHALLENGE

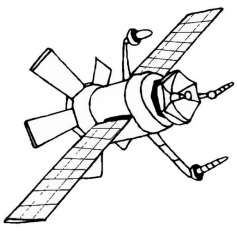
NASA's Lunar Exploration Missions

NASA's lunar exploration missions will collect scientific data to help scientists and engineers better understand the Moon's features and environment. These missions will ultimately help NASA determine the best locations for future human exploration and lunar bases.

The information gathered by lunar exploration missions will add to information collected during earlier missions. Some of these missions gathered data that caused scientists to have more questions — questions they hope to solve with new instruments. For example: scientists and engineers need to know if there is any ice on the Moon. Humans need lots of water to live, and it is way too heavy to carry with us up to the Moon! One lunar exploration mission will carry instruments (sometimes called "detectors" or "sensors") to look for ice (water in solid form). Additionally, NASA needs to make exact maps of the Moon's surface so that a safe landing site may be chosen. And, for safety, we need to make careful measurements of the radiation falling on the lunar surface.

The different instruments are designed, tested, and assembled by different teams of engineers and scientists. The separate teams must work together to make sure that the instruments are the right weight, fit correctly, and make proper measurements. Working together is an important skill for students to practice.

Overall, the weight (strictly speaking, the mass) of anything we want to send into space is the most challenging problem for the engineers. The more an object weighs, the more energy it takes to launch it.



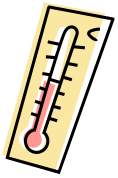
The Challenge: *Your mission is to build a model of a lunar exploration satellite with the general building supplies available. Use different shape/sizes of buttons to represent the various instruments. The challenge is to use a combination of instruments that cannot go above four (4) solar cells to power your satellite.*

IMAGINE AND PLAN

The objective of this activity is to design your own satellite. These are the instruments you may choose to put on your satellite:

Camera
(takes pictures)

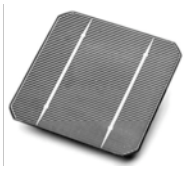
Gravity Probe
(measures gravity)

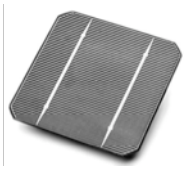


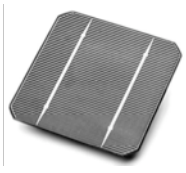
Heat Sensor
(measures temperature)

Each of these instruments requires a certain number of solar cells to operate on your satellite. A solar cell  is a battery that collects energy from the sun to power the instruments.

needs







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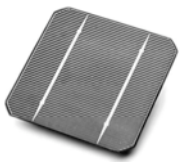

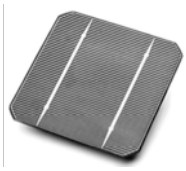

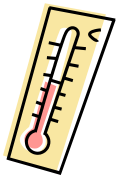

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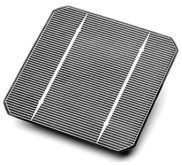

IMAGINE AND PLAN (continued)

Using the diagram on the previous page, if you were to build a satellite with one (1) camera and one (1) heat sensor, how many solar cells would you need?

Complete the number sentence below:

_____	+	_____	=	_____
(camera)		(heat sensor)		(total solar cells)

Now draw your own satellite. Include the correct number of solar cells it will need. Make sure to label your instruments.